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FIRST CHEMICAL INVESTIGATION OF HASSIUM (Hs, Z=108)

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Abstract

We present the first successful chemical investigation of Hassium (Hs, Z=108). Relatively long-lived ($T_{1/2} \sim 10$ s) Hs nuclides were produced in the nuclear reaction $^{248}\text{Cm}(^{26}\text{Mg}; 5, 4n)^{269, 270}\text{Hs}$. Fusion products were converted to volatile HsO_4 , which was rapidly transported to a thermochromatography detection system. The deposition temperature of HsO_4 on the column surface material was measured using a column consisting of PIN diodes suitable for registering α -decaying and spontaneously-fissioning nuclides. A longitudinal negative temperature gradient from -20 to -170°C was established along the column.

A dose of $1.0 \cdot 10^{18}$ ^{26}Mg -projectiles was accumulated. Seven correlated decay chains were registered. Three were attributed to the decay of ^{269}Hs , and two chains were tentatively assigned to the decay of the new isotope ^{270}Hs . The two last decay chains were incomplete.

From the deposition temperature, the adsorption enthalpy was deduced as (-46 ± 2) kJ/mol for HsO_4 compared to (-39 ± 1) kJ/mol for OsO_4 , indicating a comparable or slightly lower volatility for HsO_4 . The formation of a highly volatile oxide justifies the classification of Hs into group 8 of the periodic table.